ADDENDA

ANSI/ASHRAE/IES Addendum y to
ANSI/ASHRAE/IES Standard 90.1-2019

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on December 9, 2021, and by the Illuminating Engineering Society on December 8, 2021.

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FOREWORD

Addendum y modifies Table 6.8.1-16, "Heat Pump and Heat Recovery Chiller Packages Minimum Efficiency Requirements" for the following:

a. Heating duty minimum efficiency compliance
b. Air-source heat pump 17°F rating efficiency requirements
c. New AHRI 550/590 and AHRI 550/591 standard
d. Miscellaneous other changes

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum y to Standard 90.1-2019

Modify Section 12 as shown (I-P).

Reference	Title
Air Conditioning, Heating and Refrigeration Institute (AHRI) 2311 Wilson Blvd., Arlington, VA 22201	
AHRI 550/590 (I-P)-20~~18~~20	Performance Rating of Water-~~C~~chilling and Heat-Pump Water-~~H~~heating Packages Using the Vapor Compression Cycle

Modify Section 12 as shown (SI).

Reference	Title
Air Conditioning, Heating and Refrigeration Institute (AHRI) 2311 Wilson Blvd., Arlington, VA 22201	
AHRI 550/591 (SI)-2020~~18~~20	Performance Rating of Water-~~C~~chilling and Heat-Pump Water-~~H~~heating Packages Using the Vapor Compression Cycle

Modify Section 3.2 as shown (I-P and SI).

heat recovery coefficient of performance (COP_{HR}): a ratio of the net heat recovery capacity plus the net refrigerating capacity to the total input power at any given set of rating conditions. COP_{HR} applies to units that are operating in a manner that uses either all or only a portion of heat generated during chiller operation to heat a load, while the remaining heat, if any, is rejected to the outdoor ambient. COP_{HR} takes into account the beneficial cooling capacity as well as the heat recovery capacity.

[. . .]

simultaneous cooling and heating coefficient of performance (COP_{SHC}): a ratio of the net heating capacity plus the net refrigerating capacity to the total input power at any given set of rating conditions. COP_{SHC} applies to units that are operating in a manner that uses both the net heating and refrigerating capacities generated during operation. COP_{SHC} takes into account the beneficial capacity as well as the heating capacity.

Modify Section 3.3 as shown (I-P and SI).

COP_{HR} heat recovery coefficient of performance

COP_{SHC} simultaneous cooling and heating coefficient of performance

Revise Section 6.4.1.1 as shown (I-P and SI).

6.4.1.1 Minimum Equipment Efficiencies—Listed Equipment—Standard Rating and Operating Conditions. *Equipment* shown in Tables 6.8.1-1 through 6.8.1-20 shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the *equipment* shall satisfy all stated requirements unless otherwise exempted by footnotes in the table. *Equipment* covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum *efficiency* requirements for operation at minimum capacity or other than standard rating conditions. *Equipment* used to provide *service water-heating* functions as part of a combination system shall satisfy all stated requirements for the appropriate *space* heating or cooling category.

[. . .]

p. Table 6.8.1-16, "Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements"

Modify Table 6.8.1-16 as shown (I-P and SI, respectively).

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (I-P)

~~Equipment~~ *Equipment* Type	Size Category Refrigerating Capacity[n] ton_R	Cooling ~~only~~ Operation ~~Cooling Efficiency~~ *Efficiency*[a,d,e,i] Air Source (~~EER~~ *EER* (~~FL/IPLV~~ *IPLV*), Btu/W·h		Heating Operation ~~Efficiency~~ *Efficiency*[b,e,i]												Test Procedure
		~~Water~~ Liquid-Source Power Input per Capacity (FL/~~IPLV~~ *IPLV*) kW/ton_R		Heating Source Conditions (~~Entering/~~ leaving ~~water~~ liquid) or OAT (db/wb)[g,o]°F	Heat Pump Heating Full Load Heating ~~Efficiency~~ *Efficiency* ($~~COP_H~~$ COP_H)[b,f,h], W/W				~~Heat Recovery Chiller Full-Load Efficiency~~ ($~~COP_{HR}$~~)[b,c,j], W/W; Simultaneous Cooling and Heating Full-Load ~~Efficiency~~ *Efficiency* ($~~COP_{SHC}$~~ COP_{SHC})[b,i], W/W				Heat Recovery Heating Full-Load *Efficiency* (COP_{HR})[c,j], W/W				
					Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating Liquid Temperature			
		Path A	Path B		Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	
					95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	90.00°F/ 140.00°F	120.00°F/ 140.00°F	
Air-source	~~All sizes~~ ≤150.0	≥9.595 FL ≥13.02 ~~IPLV.IP~~ *IPLV*.IP	≥9.215 FL ≥15.01 ~~IPLV.IP~~ *IPLV*.IP	47.00 db 43.00 wb[d,l]	≥3.290	≥2.770	≥2.310	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	AHRI 550/590
				17.00 db 15.00 wb[l]	≥2.029	≥1.775	≥1.483	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	
	≥150.0	≥9.595 FL ≥13.30 ~~IPLV.IP~~ *IPLV*.IP	≥9.215 FL ≥15.30 ~~IPLV.IP~~ *IPLV*.IP	47.00 db 43.00 wb[l]	≥3.290	≥2.770	≥2.310	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	
				17.00 db 15.00 wb[d,l]	~~≥2.230~~ ≥2.029	~~≥1.950~~ ≥1.775	~~≥1.630~~ ≥1.483	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling ~~only~~ rating conditions are standard rating conditions defined in AHRI 550/590 (I-P)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 550/590 (I-P), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water cooled~~ liquid-source heat recovery ~~chillers~~chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser the ~~COP_{HR}~~ COP_{HR} applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3.

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with Path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance COP_H is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the 47.00°F and 17.00°F heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance COP_H is only required at one of the four heating AHRI 550/590 standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes (a) and (d), except as noted in footnote (f).

i. For simultaneous cooling and heating chillers applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery COP_{SHC} is only required at one of the four simultaneous cooling and heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery COP_{HR} is only required at one of the four heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes a and d.

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full-load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid cooled chilling packages rating shall be the liquid flow rates from the cooling operation full load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 54.00°F and a leaving liquid temperature of 44.00°F shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o. A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 135,000 Btu/h are covered by Table 6.8.1.15.

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (I-P)

~~Equipment~~ *Equipment* Type	Size Category Refrigerating Capacity[n] ton_R	Cooling ~~only~~ Operation ~~Cooling Efficiency~~ *Efficiency*[a,d,e,i]; Air Source (~~EER~~ *EER* (FL/~~IPLV~~ *IPLV*), Btu/W·h; ~~Water~~Liquid-Source Power Input per Capacity (FL/~~IPLV~~ *IPLV*) kW/ton_R		Heating Operation ~~Efficiency~~ *Efficiency*[b,e,i]: Heating Source Conditions (~~Entering/~~leaving ~~water~~liquid) or OAT (db/wb)[g]°F	Heat Pump Heating Full Load Heating ~~Efficiency~~ *Efficiency* (COP_H)[b,f,h], W/W; Entering/Leaving Heating ~~Water~~ Liquid Temperature				~~Heat Recovery Chiller Full Load Efficiency~~ (COP_{HR})[b,e,i], W/W; Simultaneous Cooling and Heating Full-Load ~~Efficiency~~ *Efficiency* (COP_{SHC})[b,i], W/W; Entering/Leaving Heating ~~Water~~ Liquid Temperature				Heat Recovery Heating Full-Load *Efficiency* (COP_{HR})[c,i], W/W; Entering/Leaving Heating Liquid Temperature				Test Procedure
		Path A	Path B		Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	
					95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	90.00°F/ 140.00°F	120.00°F/ 140.00°F	
~~Water~~ Liquid-source electrically operated positive displacement	≥11.25[q] and <75.00	≤~~0.7885~~ 0.7895 FL ≤0.6316 ~~IPLV.IP~~ *IPLV*.IP	≤~~0.7875~~-0.8211FL ≤~~0.5145~~-0.5263 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[em]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	AHRI 550/590
				~~75~~/65.00 [em]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥75.00 and <150.0	≤0.7579 FL ≤0.5895 ~~IPLV.IP~~ *IPLV*.IP	≤~~0.7140~~-0.7895 FL ≤~~0.4620~~-0.5158 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[em]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	
				~~75~~/65.00 [em]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥150.0 and <300.0	≤0.6947 FL ≤0.5684 ~~IPLV.IP~~ *IPLV*.IP	≤~~0.7140~~-0.7158 FL ≤~~0.4620~~-0.4632 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[em]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	
				~~75~~/65.00 [em]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥300.0 and <600.0	≤0.6421 FL ≤0.5474 ~~IPLV.IP~~ *IPLV*.IP	≤~~0.6563~~-0.6579 FL ≤~~0.4305~~-0.4316 ~~IPLV.IP~~-*IPLV*.IP	~~54~~/44.00[em]	≥4.930	≥3.960	≥2.970	NA[p]	≥8.900	≥6.980	≥5.000	NA[p]	≥8.900	≥6.980	≥5.500	≥5.000	
				~~75~~/65.00 [em]	NA[p]	NA[p]	NA[p]	≥3.900	NA[p]	NA[p]	NA[p]	≥6.850	NA[p]	NA[p]	NA[p]	NA[p]	
	≥600.0	≤0.5895 FL ≤0.5263 ~~IPLV.IP~~ *IPLV*.IP	≤~~0.6143~~0.6158 FL ≤~~0.3990~~0.4000 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[em]	≥4.930	≥3.960	≥2.970	NA[p]	≥8.900	≥6.980	≥5.000	NA[p]	≥8.900	≥6.980	≥5.500	≥5.000	
				~~75~~/65.00 [em]	NA[p]	NA[p]	NA[p]	≥3.900	NA[p]	NA[p]	NA[p]	≥6.850	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling ~~only~~ rating conditions are standard rating conditions defined in AHRI 550/590 (I-P)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 550/590 (I-P), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water cooled~~ liquid-source heat recovery ~~chillers~~chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser the ~~COP_{HR}~~ COP_{HR} applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3.

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with Path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance COP_H is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the 47.00°F and 17.00°F heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance COP_H is only required at one of the four heating AHRI 550/590 standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes (a) and (d), except as noted in footnote (f).

i. For simultaneous cooling and heating chillers applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery COP_{SHC} is only required at one of the four simultaneous cooling and heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery COP_{HR} is only required at one of the four heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes a and d.

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full-load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid cooled chilling packages rating shall be the liquid flow rates from the cooling operation full load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 54.00°F and a leaving liquid temperature of 44.00°F shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 135,000 Btu/h are covered by Table 6.8.1.15.

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (I-P)

~~Equipment~~ *Equipment* Type	Size Category Refrigerating Capacity[n] ton_R	Cooling ~~only~~ Operation ~~Cooling Efficiency~~ *Efficiency*[a,d,e,i] Air Source (~~EER~~ *EER* (FL/~~IPLV~~ *IPLV*), Btu/W·h ~~Water~~ Liquid-Source Power Input per Capacity (FL/~~IPLV~~ *IPLV*) kW/ton_R		Heating Operation ~~Efficiency~~ *Efficiency*[b,e,i]													
				Heating Source Conditions (~~Entering/~~ leaving ~~water~~liquid) or OAT (db/wb)[g] °F	Heat Pump Heating Full Load Heating ~~Efficiency~~ *Efficiency* (COP_H)[b,f,h], W/W				~~Heat Recovery Chiller Full Load Efficiency~~ (COP_{HR})[b,e,i], W/W Simultaneous Cooling and Heating Full-Load ~~Efficiency~~ *Efficiency* (COP_{SHC})[b,i], W/W				Heat Recovery Heating Full-Load *Efficiency* (COP_{HR})[e,i], W/W			
					Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating Liquid Temperature			
		Path A	Path B		Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	Test Procedure
					95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	90.00°F/ 140.00°F	120.00°F/ 140.00°F	
~~Water~~ Liquid-source electrically operated centrifugal	≥11.25[q] and <75.00	≤0.6421 FL ≤0.5789 ~~IPLV.IP~~ *IPLV*.IP	≤0.7316 FL ≤0.4632 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[~~e~~m]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	AHRI 550/590
				~~75~~/65.00 [~~e~~m]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥75.00 and <150.0	≤0.5895 FL ≤0.5474 ~~IPLV.IP~~ *IPLV*.IP	≤0.6684 FL ≤0.4211 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[~~e~~m]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	
				~~75~~/65.00 [~~e~~m]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥150.0 and <300.0	≤0.5895 FL ≤0.5263 ~~IPLV.IP~~ *IPLV*.IP	≤0.6263 FL ≤0.4105 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[~~e~~m]	≥4.640	≥3.680	≥2.680	NA[p]	≥8.330	≥6.410	≥4.420	NA[p]	≥8.330	≥6.410	≥4.862	≥4.420	
				~~75~~/65.00 [~~e~~m]	NA[p]	NA[p]	NA[p]	≥3.550	NA[p]	NA[p]	NA[p]	≥6.150	NA[p]	NA[p]	NA[p]	NA[p]	
	≥300.0 and <600.0	≤0.5895 FL ≤0.5263 ~~IPLV.IP~~ *IPLV*.IP	≤0.6158 FL ≤0.4000 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[~~e~~m]	≥4.930	≥3.960	≥2.970	NA[p]	≥8.900	≥6.980	≥5.000	NA[p]	≥8.900	≥6.980	≥5.500	≥5.000	
				~~75~~/65.00 [~~e~~m]	NA[p]	NA[p]	NA[p]	≥3.900	NA[p]	NA[p]	NA[p]	≥6.850	NA[p]	NA[p]	NA[p]	NA[p]	
	≥600.0	≤0.5895 FL ≤0.5263 ~~IPLV.IP~~ *IPLV*.IP	≤0.6158 FL ≤0.4000 ~~IPLV.IP~~ *IPLV*.IP	~~54~~/44.00[~~e~~m]	≥4.930	≥3.960	≥2.970	NA[p]	≥8.900	≥6.980	≥5.000	NA[p]	≥8.900	≥6.980	≥5.500	≥5.000	
				~~75~~/65.00 [~~e~~m]	NA[p]	NA[p]	NA[p]	≥3.900	NA[p]	NA[p]	NA[p]	≥6.850	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling ~~only~~ rating conditions are standard rating conditions defined in AHRI 550/590 (I-P)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 550/590 (I-P), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water cooled~~ liquid-source heat recovery ~~chillers~~chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser the ~~COP_{HR}~~ COP_{HR} applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3.

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with Path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance COP_H is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the 47.00°F and 17.00°F heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance COP_H is only required at one of the four heating AHRI 550/590 standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes (a) and (d), except as noted in footnote (f).

i. For simultaneous cooling and heating chillers applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery COP_{SHC} is only required at one of the four simultaneous cooling and heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery COP_{HR} is only required at one of the four heating AHRI 550/590 (I-P) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes a and d.

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full-load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid cooled chilling packages rating shall be the liquid flow rates from the cooling operation full load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 54.00°F and a leaving liquid temperature of 44.00°F shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o. A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 135,000 Btu/h are covered by Table 6.8.1.15.

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (SI)

~~Equipment~~ *Equipment* Type	Size Category refrigerating capacity[n] ~~kW~~*kW*	Cooling ~~only~~ Operation ~~Cooling Efficiency~~*Efficiency*[a,b,d,e,i] (Air Source ~~COP~~*COP*$_C$, FL/~~IPLV~~*IPLV*-W/W) ~~Water~~ Liquid ~~Source Power Input per Capacity~~ *COP*$_C$ (FL/~~IPLV~~*IPLV*) W/W		Heating Source Conditions (~~Entering/~~ leaving ~~water~~liquid) or OAT (db/wb)[g] °C	Heating Operation *Efficiency*,[b,e,i] Heat Pump Heating Full Load Heating ~~Efficiency~~*Efficiency* (~~COP$_H$~~*COP*$_H$)[b,f,h], W/W				~~Heat Recovery Chiller Full-Load Efficiency (COP$_{HR}$)[b,c],W/W~~ Simultaneous Cooling and Heating Full-Load ~~Efficiency~~*Efficiency* (~~COP$_{SHC}$~~*COP*$_{SHC}$)[b,i],W/W				Heat Recovery Heating Full-Load *Efficiency* (*COP*$_{HR}$)[c,i],W/W				Test Procedure
					Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating Liquid Temperature				
		Path A	Path B		Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	
					35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	32.00°C/ 60.00°C	50.00°C/ 60.00°C	
Air-source	~~All sizes~~ <527.0	≥2.836 FL ≥3.846 ~~IPLV~~*IPLV*.SI	≥2.723 FL ≥4.436 ~~IPLV~~*IPLV*.SI	8.00 db[d] 6.00 wb[l]	≥3.250	≥2.720	≥3.330	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	AHRI 551/591
				–8.00 db –9.00 wb[l]	≥2.048	≥1.747	≥1.492	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	
	≥527.0	≥2.836 FL ≥3.930 ~~IPLV~~*IPLV*.SI	≥2.723 FL ≥4.520 ~~IPLV~~*IPLV*.SI	8.00 db[d] 6.00 wb[l]	≥3.250	≥2.720	≥3.330	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	
				–8.00 db[d] –9.00 wb[l]	~~≥2.250~~ ≥2.048	~~≥1.920~~ ≥1.747	~~≥1.640~~ ≥1.492	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling rating conditions are standard rating conditions defined in AHRI 551/591 (SI)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages, which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 551/591 (SI), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water-cooled~~liquid-source heat recovery ~~chillers~~ chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser, the ~~COP$_{HR}$~~ *COP*$_{HR}$ applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance *COP*$_H$ is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the –8.00°C and 8.00°C heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance *COP*$_H$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes a and d, except as noted in footnote f.

i. For simultaneous cooling and heating chilling package applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery *COP*$_{SHC}$ is only required at one of the four simultaneous cooling and heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling-only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery *COP*$_{HR}$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid-cooled chilling packages rating shall be the liquid flow rates from the cooling operation full-load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 12.00°C and a leaving liquid temperature of 7.00°C shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 39.57 kW are covered by Table 6.8.1.15.

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (SI)

~~Equipment~~ *Equipment* Type	Size Category refrigerating capacity[n] ~~kW~~*kW*	Cooling ~~only~~ Operation ~~Cooling Efficiency~~*Efficiency*[a,b,d,e,i] (Air Source ~~COP~~*COPc*, FL/~~IPLV~~*IPLV*-W/W) ~~Water~~ Liquid ~~Source Power Input per Capacity~~ *COPc* (FL/~~IPLV~~*IPLV*) W/W		Heating Operation *Efficiency*[b,e,i]												Test Procedure
				Heating Source Conditions (~~Entering/~~ leaving ~~water~~liquid) or OAT (db/wb)[g] °C	Heat Pump Heating Full Load Heating ~~Efficiency~~*Efficiency* (~~COP~~$_H$*COP*$_H$)[b,f,h], W/W				~~Heat Recovery Chiller Full-Load Efficiency (COP$_{HR}$)[b,c],W/W~~ Simultaneous Cooling and Heating Full-Load ~~Efficiency~~*Efficiency* (~~COP$_{SHC}$~~ *COP*$_{SHC}$)[b,i],W/W				Heat Recovery Heating Full-Load *Efficiency* (*COP*$_{HR}$)[c,i],W/W				
					Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating Liquid Temperature			
					Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	
		Path A	Path B		35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	32.00°C/ 60.00°C	50.00°C/ 60.00°C	
~~Water~~ Liquid-source electrically operated positive displacement	≥39.57[q] and <264.0	≥~~4.659~~ 4.459 FL ≥5.574 ~~IPLV~~*IPLV*.SI	≥4.287 FL ≥6.689 ~~IPLV~~*IPLV*.SI	~~12~~/7.00[~~em~~]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	AHRI 551/ 591
				~~24~~/19.00[~~em~~]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥264.0 and <528.0	≥4.645 FL ≥5.972 ~~IPLV~~*IPLV*.SI	≥4.459 FL ≥6.825 ~~IPLV~~*IPLV*.SI	~~12~~/7.00[~~em~~]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	
				~~24~~/19.00[~~em~~]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥528.0 and <1055	≥5.067 FL ≥6.193 ~~IPLV~~*IPLV*.SI	≥4.918 FL ≥7.601 ~~IPLV~~*IPLV*.SI	~~12~~/7.00[~~em~~]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	
				~~24~~/19.00[~~em~~]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥1055 and <2110	≥5.482 FL ≤6.432 ~~IPLV~~*IPLV*.SI	≥5.351 FL ≤8.157 ~~IPLV~~*IPLV*.SI	~~12~~/7.00[~~em~~]	≥5.060	≥3.880	≥2.950	NA[p]	≥9.140	≥6.850	≥4.960	NA[p]	≥9.140	≥6.850	≥5.456	≥4.960	
				~~24~~/19.00[~~em~~]	NA[p]	NA[p]	NA[p]	≥3.870	NA[p]	NA[p]	NA[p]	≥6.800	NA[p]	NA[p]	NA[p]	NA[p]	
	≥2110	≥~~5.072~~ 5.972 FL ≥6.689 ~~IPLV~~*IPLV*.SI	≥5.717 FL ≥8.801 ~~IPLV~~*IPLV*.SI	~~12~~/7.00[~~em~~]	≥5.060	≥3.880	≥2.950	NA[p]	≥9.140	≥6.850	≥4.960	NA[p]	≥9.140	≥6.850	≥5.456	≥4.960	
				24/19.00[~~em~~]	NA[p]	NA[p]	NA[p]	≥3.870	NA[p]	NA[p]	NA[p]	≥6.800	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling rating conditions are standard rating conditions defined in AHRI 551/591 (SI)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages, which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 551/591 (SI), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water-cooled~~liquid-source heat recovery ~~chillers~~ chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser, the ~~COP$_{HR}$~~ *COP*$_{HR}$ applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance *COP*$_H$ is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the –8.00°C and 8.00°C heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance *COP*$_H$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes a and d, except as noted in footnote f.

i. For simultaneous cooling and heating chilling package applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery *COP*$_{SHC}$ is only required at one of the four simultaneous cooling and heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling-only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery *COP*$_{HR}$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid-cooled chilling packages rating shall be the liquid flow rates from the cooling operation full-load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 12.00°C and a leaving liquid temperature of 7.00°C shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 39.57 kW are covered by Table 6.8.1.15.

TABLE 6.8.1-16 Heat Pump and Heat Recovery ~~Chiller~~ Water-Chilling Packages—Minimum *Efficiency* Requirements (SI)

~~Equipment~~ *Equipment* Type	Size Category refrigerating capacity[n] ~~kW~~*kW*	Cooling ~~only~~ Operation ~~Cooling Efficiency~~*Efficiency*[a,b,d,e,j] (Air Source ~~COP~~*COPc*, FL/~~IPLV~~*IPLV*-W/W) ~~Water~~ Liquid ~~Source Power Input per Capacity~~ *COPc* (FL/~~IPLV~~*IPLV*) W/W		Heating Operation *Efficiency*,[b,e,j]												Test Procedure
				Heating Source Conditions (~~Entering/~~ leaving ~~water~~liquid) or OAT (db/wb)[g] °C	Heat Pump Heating Full Load Heating ~~Efficiency~~*Efficiency* (~~COP~~$_H$*COP*$_H$)[b,f,h], W/W				~~Heat Recovery Chiller Full-Load Efficiency (COP$_{HR}$)[b,c],W/W~~ Simultaneous Cooling and Heating Full-Load ~~Efficiency~~*Efficiency* (~~COP$_{SHC}$~~ *COP*$_{SHC}$)[b,i],W/W				Heat Recovery Heating Full-Load *Efficiency* (*COP*$_{HR}$)[c,i],W/W				
					Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating ~~Water~~ Liquid Temperature				Entering/Leaving Heating Liquid Temperature			
					Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot-Water 1	Hot-Water 2	
		Path A	Path B		35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	50.00°C/ 60.00°C	50.00°C/ 60.00°C	35.00°C/ 40.00°C	42.00°C/ 50.00°C	32.00°C/ 60.00°C	50.00°C/ 60.00°C	
~~Water~~ Liquid-source electrically operated centrifugal	< 264.0	≥5.482 FL ≥6.081 ~~IPLV.SI~~*IPLV*.SI	≥4.812 FL ≥7.601 ~~IPLV.SI~~*IPLV*.SI	~~12~~/7.00[-em]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	AHRI 551/ 591
				~~24~~/19.00[-em]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥264.0 and <528.0	≥5.482 FL ≥6.081 ~~IPLV.SI~~*IPLV*.SI	≥5.267 FL ~~≥6.361~~ 8.361 ~~IPLV.SI~~*IPLV*.SI	~~12~~/7.00[-em]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	
				~~24~~/19.00[-em]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥528.0 and <1055	≥5.972 FL ≥6.432 ~~IPLV.SI~~*IPLV*.SI	≥5.621 FL ~~≥8.567~~ 8.576 ~~IPLV.SI~~*IPLV*.SI	~~12~~/7.00[-em]	≥4.760	≥3.610	≥2.660	NA[p]	≥8.550	≥6.290	≥4.390	NA[p]	≥8.550	≥6.290	≥4.829	≥4.390	
				~~24~~/19.00[-em]	NA[p]	NA[p]	NA[p]	≥3.530	NA[p]	NA[p]	NA[p]	≥6.100	NA[p]	NA[p]	NA[p]	NA[p]	
	≥1055 and <2110	≥5.972 FL ≥6.689 ~~IPLV.SI~~*IPLV*.SI	≥5.717 FL ≥8.801 ~~IPLV.SI~~*IPLV*.SI	~~12~~/7.00[-em]	≥5.060	≥3.880	≥2.950	NA[p]	≥9.140	≥6.850	≥4.960	NA[p]	≥9.140	≥6.850	≥5.456	≥4.960	
				~~24~~/19.00[-em]	NA[p]	NA[p]	NA[p]	≥3.870	NA[p]	NA[p]	NA[p]	≥6.800	NA[p]	NA[p]	NA[p]	NA[p]	
	≥2110	≥5.972 FL ≥6.689 ~~IPLV.SI~~*IPLV*.SI	≥5.717 FL ≥8.801 ~~IPLV.SI~~*IPLV*.SI	~~12~~/7.00[-em]	≥5.060	≥3.880	≥2.950	NA[p]	≥9.140	≥6.850	≥4.960	NA[p]	≥9.140	≥6.850	≥5.456	≥4.960	
				24/19.00[-em]	NA[p]	NA[p]	NA[p]	≥3.870	NA[p]	NA[p]	NA[p]	≥6.800	NA[p]	NA[p]	NA[p]	NA[p]	

a. Cooling rating conditions are standard rating conditions defined in AHRI 551/591 (SI)Table ~~1~~4, except for liquid-cooled centrifugal chilling packages, which can adjust cooling *efficiency* for nonstandard rating conditions using K_{adj} procedure in accordance with Section 6.4.1.2.1.

b. Heating full-load rating conditions are at standard rating conditions defined in AHRI 551/591 (SI), Table ~~1~~4; includes the impact of defrost for air-source heating ratings.

c. For ~~water-cooled~~liquid-source heat recovery ~~chillers~~ chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser, the ~~COP$_{HR}$~~ *COP*$_{HR}$ applies to operation at full load with 100% heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 6.8.1-3

d. For cooling operation, compliance with both the FL and *IPLV* is required, but only compliance with path A or Path B cooling *efficiency* is required.

e. For units that operate in both cooling and heating, compliance with both the cooling and heating *efficiency* is required.

f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance *COP*$_H$ is required at only one of the heating AHRI 550/590 (I-P) standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.

g. For air-source heat pumps, compliance with both the –8.00°C and 8.00°C heating source *outdoor air* temperature (OAT) rating *efficiency* is required for heating.

h. For heat pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance *COP*$_H$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in footnotes a and d, except as noted in footnote f.

i. For simultaneous cooling and heating chilling package applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery *COP*$_{SHC}$ is only required at one of the four simultaneous cooling and heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling-only performance is required as defined in footnotes (a) and (d).

j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery *COP*$_{HR}$ is only required at one of the four heating AHRI 551/591 (SI) standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in footnotes (a) and (d).

k. Chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

~~d~~l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.

~~e~~m. Source ~~water entering and~~ leaving ~~water~~ liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid-cooled chilling packages rating shall be the liquid flow rates from the cooling operation full-load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 12.00°C and a leaving liquid temperature of 7.00°C shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.

o A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with Table 6.8.1-3.

p. "NA" means the requirements are not applicable.

q. Water-to-water heat pumps with a capacity less than 39.57 kW are covered by Table 6.8.1.15.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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